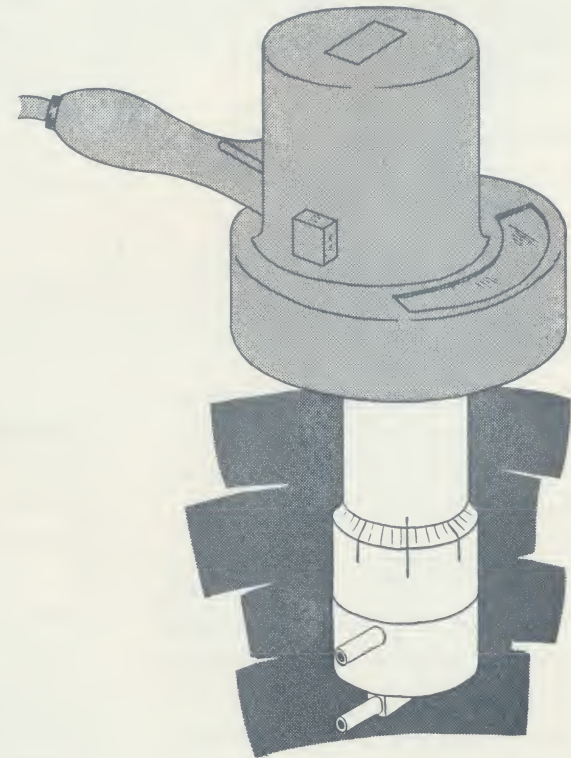
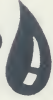


WELLS - BROOKFIELD MICRO VISCOMETER



*...for measurement of 1 cc samples
at discreet rates of shear...*

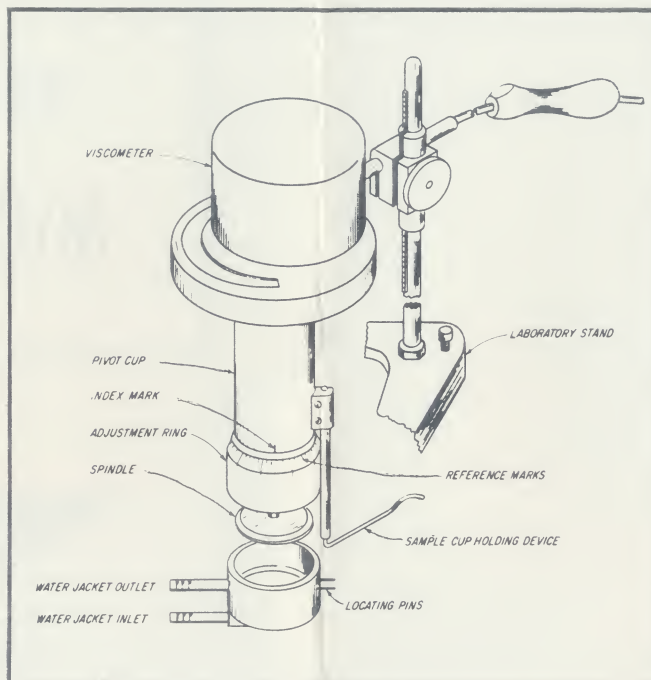
BROOKFIELD  **ENGINEERING LABORATORIES
INCORPORATED**
SPECIALISTS IN THE MEASUREMENT AND CONTROL OF VISCOSITY
STOUGHTON, MASSACHUSETTS PHONE FIELDBROOK 4-4310 CABLE ADDRESS BROOKFIELD

The Wells-Brookfield Micro Viscometer was developed to solve a particular problem existing in the field of medical research. Bronchial fluids and blood were known to have varying rheological characteristics -- investigation of these flow properties would aid substantially in determining the effectiveness of treatment as well as the condition of the patient.

The problems to be solved were:

1. The measurement of small volumes of fluid -- with infant patients only a few cubic centimeters were available.
2. The measurement of low viscosities -- the lower values, less than 100 centipoises, were of extreme interest.
3. Measurement at known and constant shearing rates were required in view of the non-Newtonian nature of the fluids.
4. Samples had to be measured under environmental conditions identical to those within the patient if the viscosity data was to be correlated to the patient's condition.

The cone-plate method of viscosity measurement offered a satisfactory solution to the problems posed by the requirements above. Fluid is placed between a plate and a cone, the cone being rotated at a constant speed. The torque required to maintain this rotation will be directly proportional to the viscosity of the liquid. Only a small volume is required and the shearing rate will be uniform throughout if the angle between the cone and plate is kept less than 3 degrees. Since only a thin film is measured, precise temperature control is possible. As the standard



Wells-Brookfield MICRO VISCOMETER

Brookfield Synchro-Lectric Viscometer is essentially a precise rotating torque meter, it was natural to consider it as a means for rotating and sensing the torque developed by the cone.

A flat plate -- comprising the bottom surface of a cup -- is brought to the vicinity of the cone by screwing an adapter on the Viscometer, until the surface of the plate coincides exactly with the apex that the cone would have.

This position is reached and determined in a mechanical fashion requiring no external gauge or supplementary instrumentation. The cup may then be removed from the adapter, filled with 1.0 cc of material, and then replaced without requiring further adjustment. Capillary action keeps material between cone and plate.

When used with an otherwise conventional Model LVT Synchro-Lectric Viscometer, the cone-plate arrangement will measure over the ranges and shearing rates listed below.

SPEED (RPM)	RANGE (CPS)	SHEAR (SEC ⁻¹)
60.0	0-10	230.00
30.0	0-20	115.00
12.0	0-50	46.00
6.0	0-100	23.00
3.0	0-200	11.50
1.5	0-400	5.75
0.6	0-1000	2.30
0.3	0-2000	1.15

Measurement over other ranges of viscosity but at the same shearing rates is possible through the use of other models of the Brookfield Synchro-Lectric Viscometer. Other cones may be used to increase the viscosity ranges available with a single Viscometer, although this will change the shearing and volume values given to a slight degree.

The accuracy of this system is to 1% of whatever full-scale range is employed. Reproducibility is to within 0.2% -- both of these figures assuming care in the establishment of the cone-plate clearance. The adapter-cup assembly is water jacketed so that fine control of temperature may be accomplished.

The particular characteristics of the cone-plate Viscometer make it ideally suited for medical and biophysical research. However, it will be applicable in any case where small samples must be accurately measured.